

APPENDIX 1 VEHICLE AND TEST INFORMATION

Test No.:	1250
Contract or Study Title:	SIDE IMPACT PROTECTION IN PRODUCTION VEHICLES
Test Performer:	TRANSPORT CANADA
Test Reference No.:	88-017
Test Type:	BASELINE TEST
Test Configuration:	IMPACTOR INTO VEHICLE
Closing Speed (kph):	50.2
Impact Angle (degrees):	270
Offset Distance (mm):	0
Version No.:	1
Test Objectives:	SIDE IMPACT RESEARCH
Test Date:	15-SEP-88
Contract No.:	
Test Track Surface:	CONCRETE
Test Track Condition:	DRY
Ambient Temperature (degrees Celsius):	13.887
Type of Recorder:	FM MULTIPLEXOR TAPE RECORDER
Side Impact Point (in mm):	-514.401
Total No. of Curves:	40
Test Commentary:	NO COMMENTS
VEHICLE INFORMATION:	
Vehicle No.:	2
Vehicle Make:	FORD
Vehicle Model:	TAURUS
Model Year:	1988
Engine Type:	V6 INLINE FRONT
Engine Displacement (liters):	3
Vehicle Test Weight (Kgrams):	1642.005
Vehicle Length (mm):	4791.634
Vehicle Width (mm):	1809.369
Body Type:	FOUR DOOR SEDAN
Vehicle Identification No.:	1FABP5OUXJG128782
Transmission Type:	AUTOMATIC - FRONT WHEEL DRIVE

APPENDIX 2

BROAD APPROXIMATIONS TO INJURY STATISTICS

Exact correlations to injury statistics are not possible for the new architecture. However, this section attempts to provide an indication of possible benefits in the new system in terms of the incidence of AIS 3+ injuries.

Rouhana and Foster (13) provides data on injuries from Car-Car side impact from NCSS accident data which is reproduced below. This analysis differs from that of Viano (14), of the same data in that we have a totally different architecture and do not perform analysis relative to thoracic viscous compression. Our analysis assumes that the injury is produced by the peak acceleration of the thorax.

Calibrating the table provided by Rouhana and Foster to the measured peak thoracic acceleration of 67Gs or 656 M/s/s in the test considered in this paper assuming linearity in the correlation and setting the Mean delta V to about 60% of 50.3 km/h or 8.38 m/s, gives an AIS 3+ percentage of about 9.0 % from the table1. The Millennium System peak thoracic acceleration is 29 Gs or 284 m/s/s which corresponds to 43% of the peak acceleration of the conventional architecture that should correspond with 43% of the "equivalent" mean delta V in terms of injury impact for this architecture or 3.6m/s which results in a AIS 3+ of about 2 % . **This represents a 77% drop in AIS3 + injuries.**

Table 1

Mean Delta V	Possible injury exposure		Injuries AIS 3+	
	Number	%	Number	%
M/s				
1.35	98	1.62	3	3.06
2.7	680	11.24	10	1.47
4.05	1222	20.2	28	2.29
5.4	1283	21.2	70	5.46
6.75	1049	17.34	62	5.91
8.1	866	14.31	77	8.89
9.45	341	5.64	33	9.68
10.8	142	2.35	11	7.75
12.15	151	2.5	24	15.89
13.56	86	1.42	36	41.86
14.85	62	1.02	22	35.48
16.2	33	.55	5	15.15
17.55	21	.35	3	14.29
18.9	17	.28	12	70.59
20.25	0	0	0	0

REFERENCES

1. National Highway Traffic Safety Administration, Traffic Safety Facts, 1997.
2. National Highway Traffic Safety Administration, Fatal Accident Reporting System, 1980.
3. National Highway Traffic Safety Administration, Federal Motor Vehicle Safety Standard 214, Code of Federal Regulations Title 49, Part 571.214. The Code is published annually by the Superintendent of Documents, U.S. Government Printing Office, Washington, DC, with NHTSA standards in the volume "Title 49, Parts 400 - 999."
4. Byron Block Advanced Designs for Side Impact Protection, 16th International Technical Conference on the Enhanced Safety of Vehicles (ESV), Volume 3, pages 1778 - 792, NHTSA Technical Report DOT HS 808 759, October, 1998 This is available from the National Technical Information Service, Arlington, Virginia.
5. Hansun Chan, James R. Hackney, Richard M. Morgan, and Heather E. Smith, An Analysis of NCAP Side Impact Crash Data, Volume 3, pages 2490 - 2502, 16th ESV, NHTSA Technical Report DOT HS 808 759, October, 1998.
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7. Charles F. Warner (Collision Safety Engineering, Orem, Utah), Inflatable Structures for Enhanced Side Impact Crash Protection, Final Report of the Small Business Innovative Research contract #DTRS-57-87-C-00089, April, 1988.
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10. Rajasingham, A.I. Unpublished research 1993-2000 prior to pending patents.
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12. Claes Tingvall, Anders Lie, "the indications of the zero vision on biomechanics Research". International IRCOBI Conference on the Biomechanics of Injury, December 1996.
13. Rauhana, SW and Foster, M.E., "Lateral impact - An analysis of the statistics in the NCSS" SAE 851727, 1985.
14. Viano David. C. "Evaluation of the benefits of Energy Absorbing Materials in Side impact Protection: Part-1". SAE 872212. 1987.
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TOP SECRET - 44-38861-250

ILLUSTRATION-1.



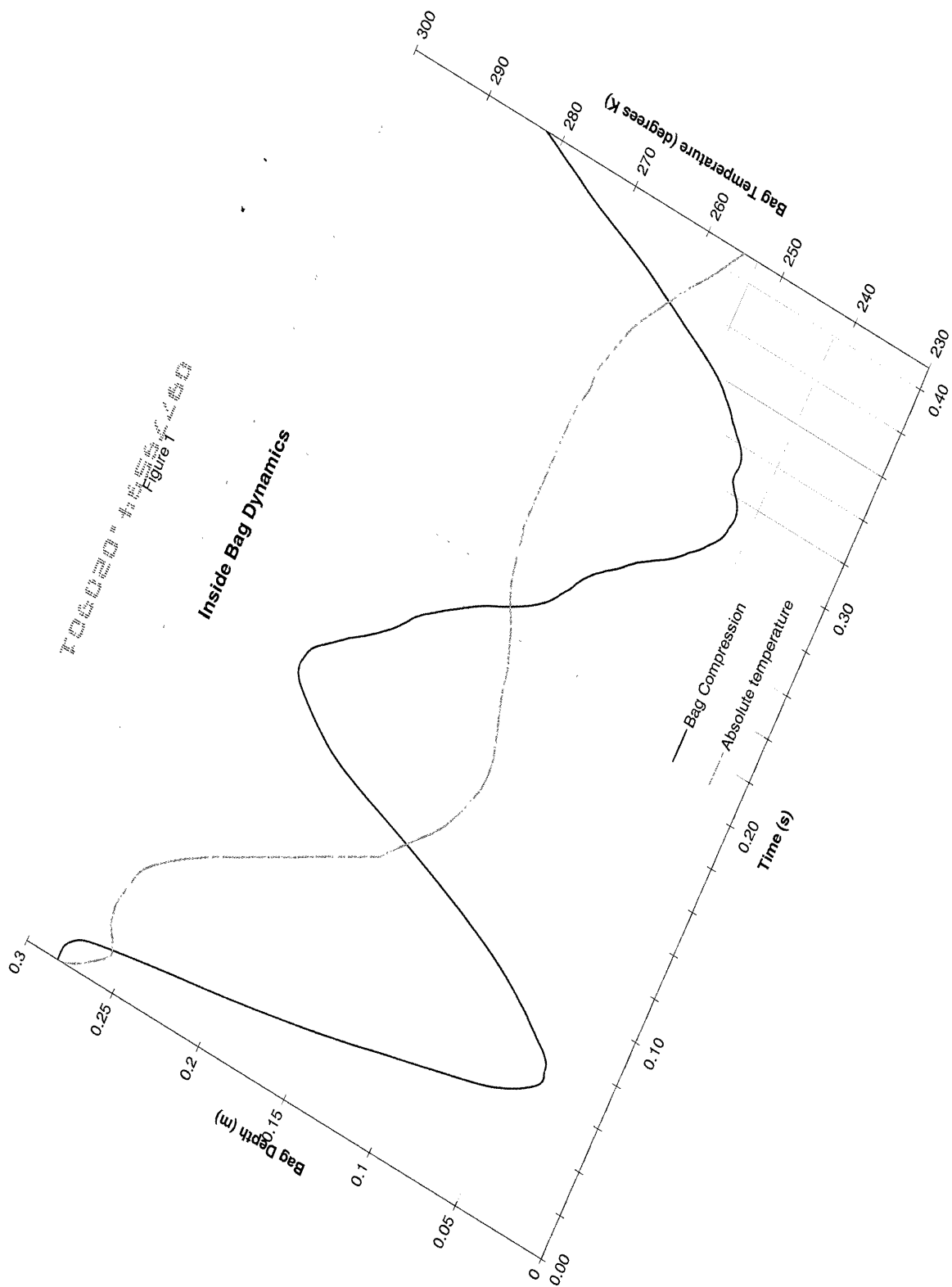


Figure 1-10

Figure 2

Acceleration **External Airbag failure** **(worst case)**

- Door - Unfiltered
- Door - Filtered
- Actual Pelvis
- Millennium

Acc (Gs)

Time (s)

200

150

100

50

0

0.00

0.05

0.10

0.15

0.20

0.25

0.30

0.35

0.40

-50

Figure 3

Velocity Impacting surface & Human carriage

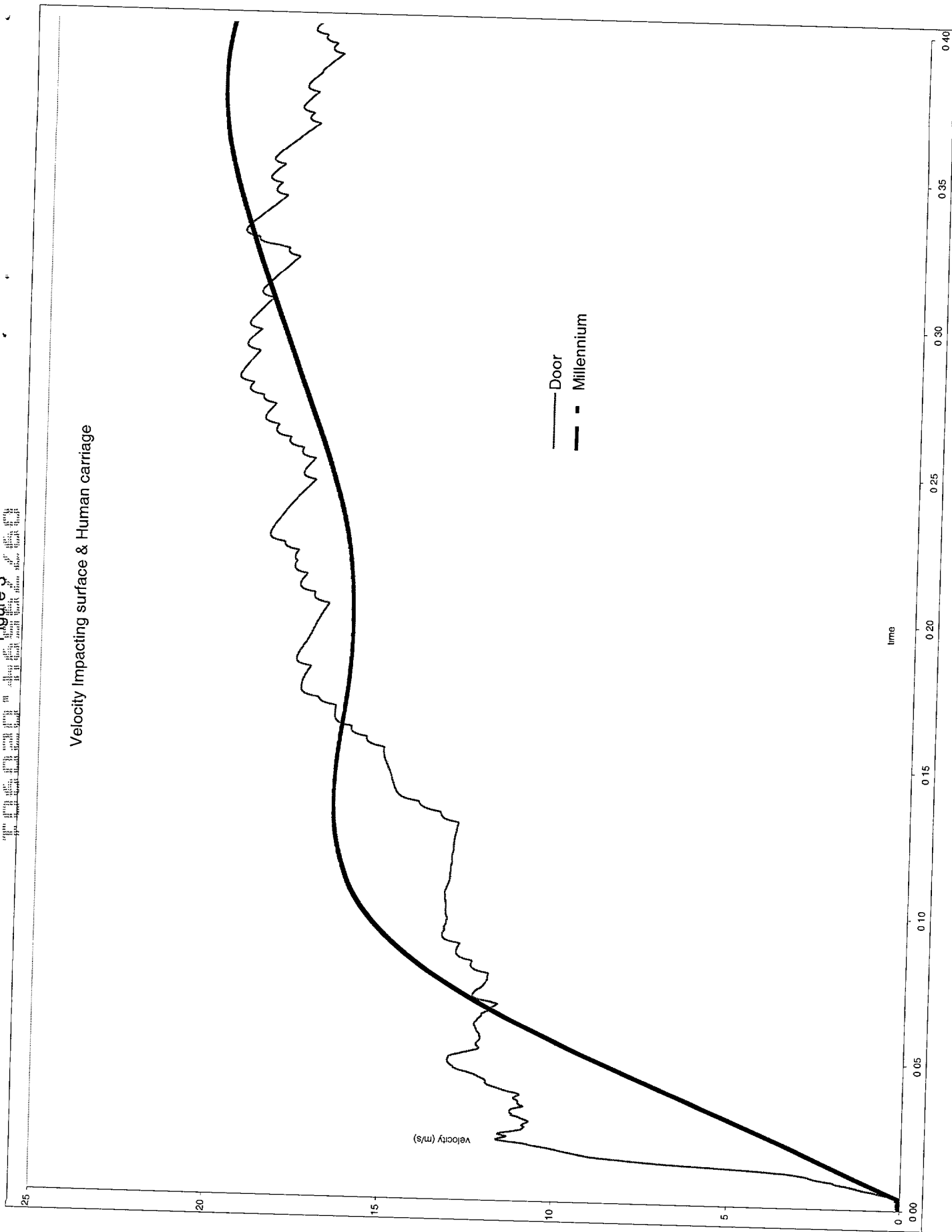
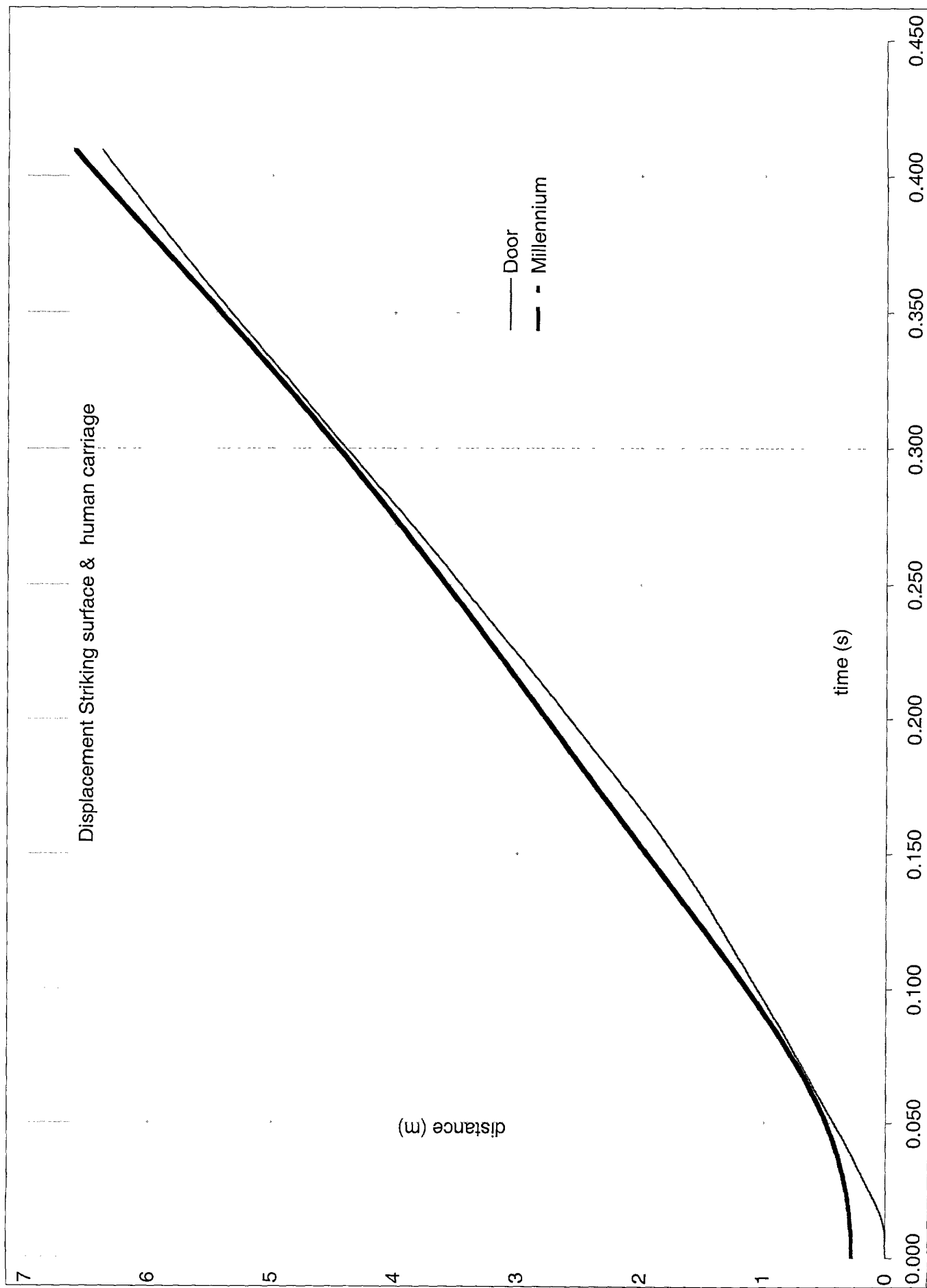
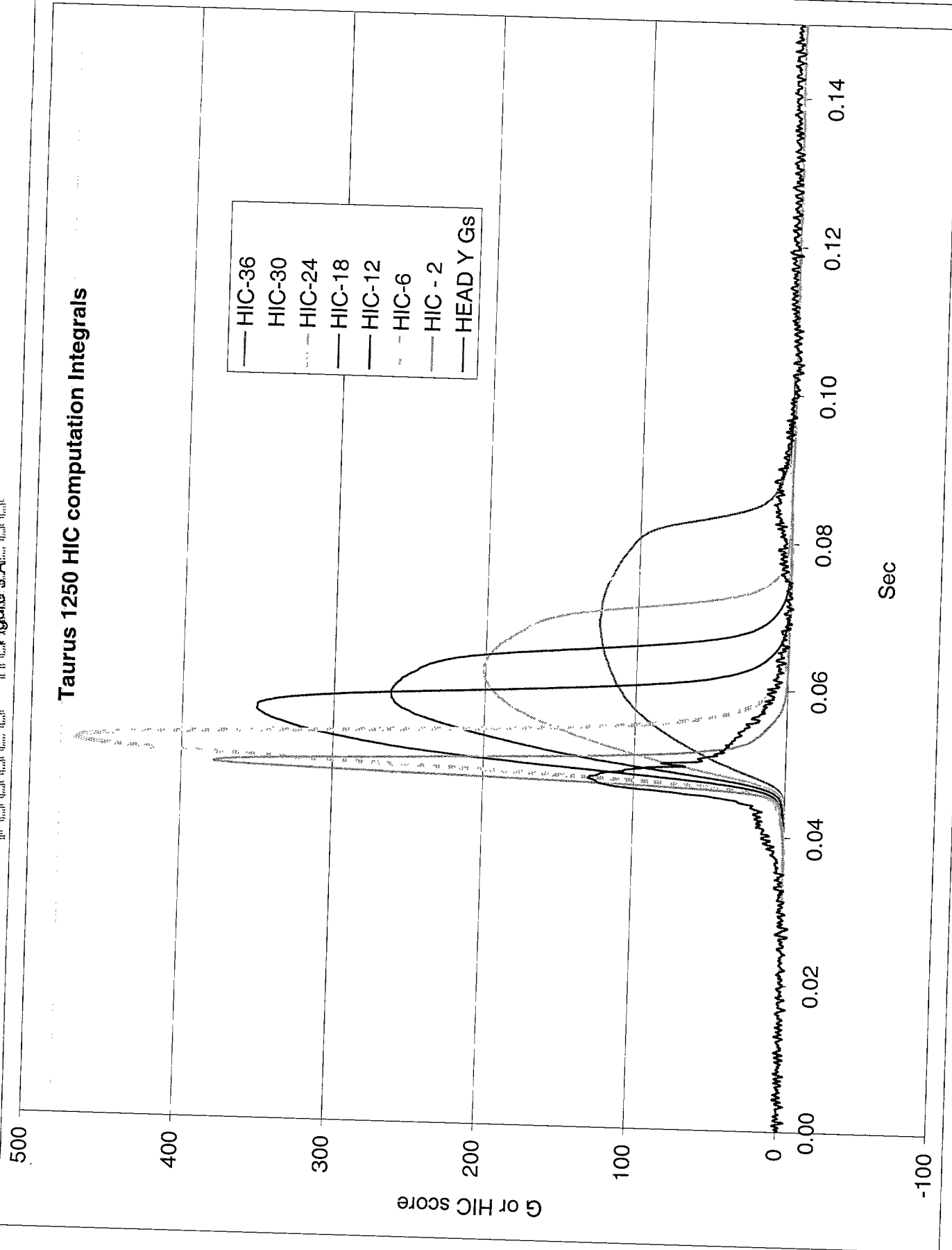


Figure 4.2.6a

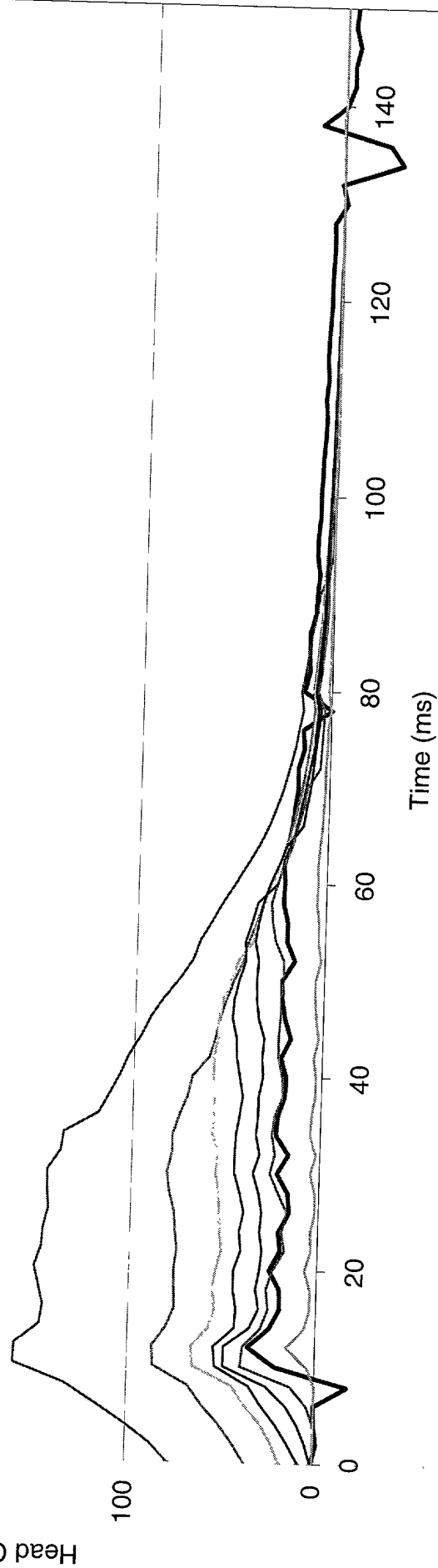


Taurus 1250 HIC computation Integrals



HIC Integral Time series - Millennium System

- Head Gs
- HIC - 36 Millennium
- HIC - 30 Millennium
- HIC - 24 Millennium
- HIC - 18 Millennium
- HIC - 12 Millennium
- HIC - 6 Millennium
- HIC - 2 Millennium



Chest Acceleration - Standard architecture

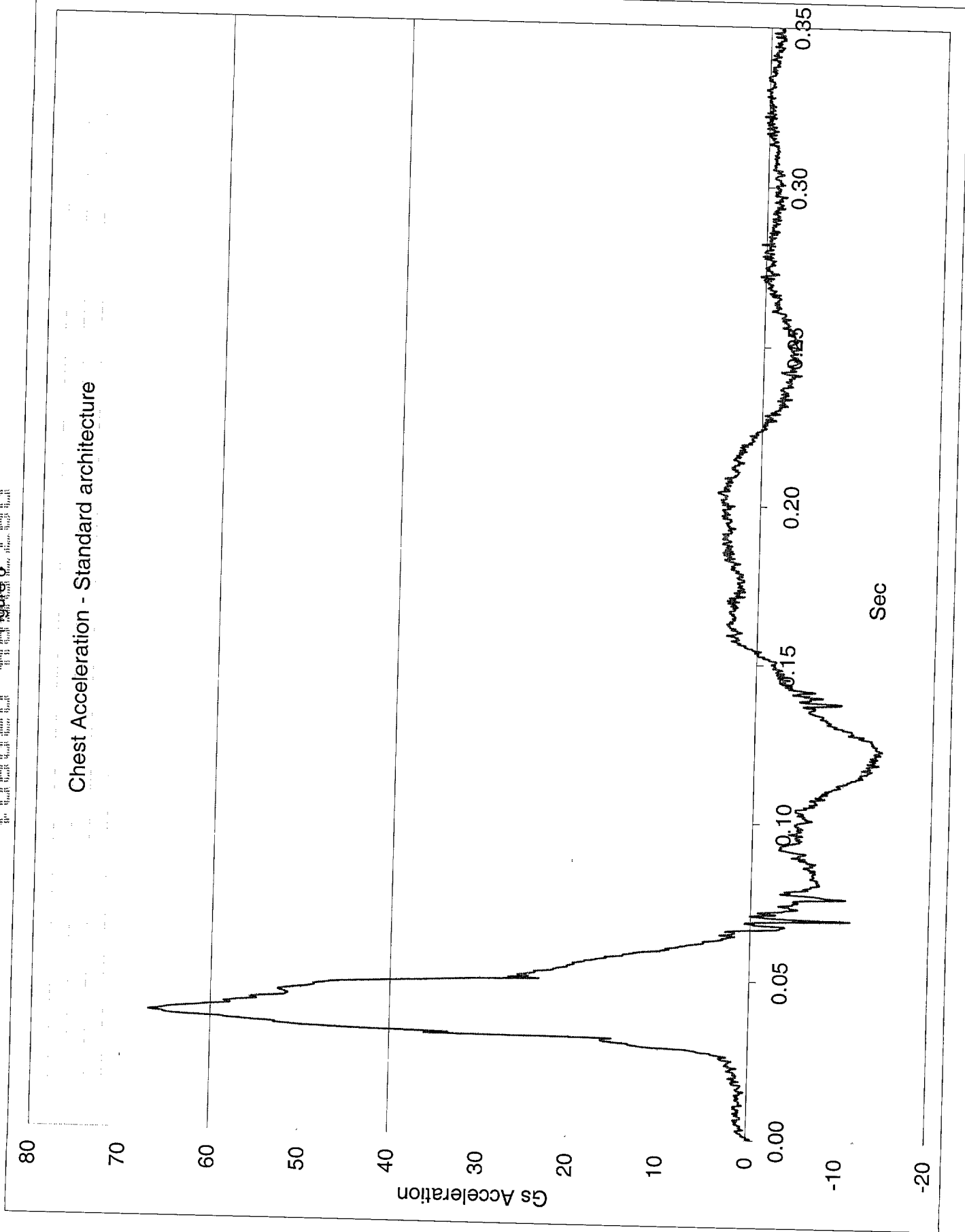


FIG 6-A

